REMARKS

Claims 1-3, 8-10, 13, 14, 21, 23, 25, 30, 65-68, 71 and 73 are rejected. Claims 6, 7, 11, 12, 15-20, 22, 24, 26-28, 31-34, 36-59, 61-64, 69, 70 and 72 are withdrawn. Claims 1, 10, 13, 65, 68 and 73 have been amended, claims 9, 25, 30 and 67 have been canceled, and claim 74 is new. Claims 1 and 65 are in independent form. Favorable reconsideration of the application is respectfully requested in light of the foregoing amendments and the remarks that follow.

I. Claim Rejections:

A. Claims 1-3, 8-10, 13, 14, 21, 23, 25, 30, 65-68, 71 and 73 stand rejected under 35 U.S.C. 103(a) as being unpatentable over EP 1225648 (Shibata) in view of U.S. Pre-Grant Publication No. 2002/0048699 (Steele). Independent claims 1 and 65 each recite a member having a porous region bounded by a non-porous region, the non-porous region creating a gas-tight seal which prevents direct combination of oxidant and fuel. Applicant submits one of skill in the art would not combine Shibata with Steele to produce such a feature.

Applicant previously observed that there would be no motivation for a person of skill in the art to combine selected features of a porous, air-side only, titanium, adhering cathode layer as taught in Shibata with a ferritic stainless steel substrate exposed to both air and fuel as taught in Steele. The functions of the layer and the substrate are substantially different and thus there would be no motivation to combine them.

In that regard, the adhering cathode layer of Shibata has a principal function which is to adhere the air electrode to the electrolyte. (Shibata at paragraph 0011). In order for the fuel cell of Shibata to function, the adhering cathode layer must be thin and porous, as evidenced in paragraph [0028] where Shibata states that "because the adhering cathode layer 21 is a dense film, it is difficult for the reactive gas to reach the three-phase interface when the thickness of the adhering cathode layer 21 is too thick." Shibata provides examples of acceptable adhering cathode layers having a thickness of 2 to 3 μm (paragraph [0061]), 50 nm (paragraph [0076]), 0.5 μm (paragraph [0090]), and 1 μm (paragraph [0110]). Evidently, these layers are much too thin to be self supporting over any significant distance. Therefore, if Shibata were to be modified by extending the layer beyond the electrolyte and reducing the porosity to zero in the extended portions to provide a non-porous region bounding the

existing porous region, one would have to thicken the layer to make it self supporting. As soon as the layer is thickened, however, the layer would fail in its principal functions of adhering the air electrode to the electrolyte and allowing gases to pass through. That is, the thickened layer would now provide a substantial barrier to the passage of gases, thereby preventing the fuel cell from functioning. "A reference may be said to teach away when a person of ordinary skill, upon reading the reference, would be discouraged from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the applicant." *In re Gurley*, 27 F.3d 551, 553 (Fed. Cir. 1994). Accordingly, Shibata, teaches away from the claimed fuel cell that includes a member having a porous region bounded by a non-porous region, the non-porous region creating a gas-tight seal which prevents direct combination of oxidant and fuel.

The examiner may argue that one skilled in the art would not have to extend the adhering cathode layer beyond the electrolyte to introduce a non-porous bounding region. However, modifying Shibata in this manner would again prevent the fuel cell from functioning, because the non-porous region would be a barrier to the passage of gas. In view of the very clear teaching of Shibata that the adhering cathode layer should not prevent reactive gas from reaching the three-phase interface, one skilled in the art would not make such a modification.

B. Independent claims 1 and 65 require a titanium member having a porous region, and a non-porous bounding region which in the fuel cell creates a gas-tight seal preventing direct combination of oxidant and fuel. The member also is able to support one or more ceramic layers. As stated in the Declaration of Kenneth Edward Anthony Omersa, Applicant submits that he is the first to conceive of a fuel cell member having these combinations of features.

At temperature, titanium alloys and particularly non-alloyed titanium readily absorb small atoms (e.g. H, O, N, C) into their interstices. Hydrogen embrittlement is a real problem in fuel cells as either hydrogen or reformed hydrocarbons which produce hydrogen, are the main fuels. This, coupled with a parabolic increase in oxidation rate with temperature, means that pure titanium cannot in general be used continuously above 400 °C, and the most sophisticated alloy can typically only be used up to 500 °C. For these reasons, although

metallic interconnects have long been used in solid oxide fuel cells, titanium interconnects were not considered.

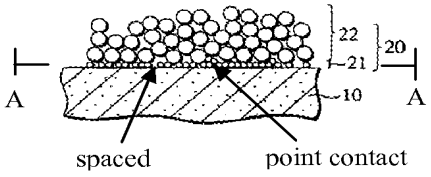
Applicant, however, realized that by using a metallic member as a support it would be possible, for example, to carry a thin ceramic electrolyte on the member, allowing the operating temperature of the fuel cell to be significantly reduced, and the drop in temperature in turn permitting titanium to be used much more widely than suggested by Shibata. In particular, applicant realized that the member, as well as supporting a ceramic layer, could take on a role of creating a gas-tight seal to prevent direct combination of oxidant and fuel. In contrast, in Shibata the thin adhering cathode layer is on the oxidant side only, is too thin to act as a support, and is entirely unsuitable for creating a gas-tight seal. There is nothing in Shibata, or in Steele for that matter, to suggest an expanded role for titanium in a fuel cell, as required by claims 1 and 65.

C. Finally, the office action admits that Shibata does not teach a porous region bounded by a non-porous region, however, the office action takes the view that adhering cathode layer 21 of Figures 1A and 1B of Shibata and adhering cathode layer 23 of Figure 2 of Shibata have porous and non-porous regions. Applicant respectfully submits that the office action's position is incorrect.

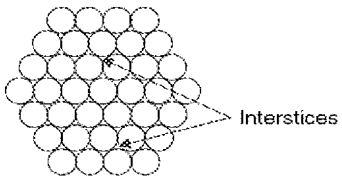
Shibata explains that the adhering cathode layers are formed of a conductive material having a particle diameter of 0.5 μm or less (*See* paragraph [0031]). Shibata goes on to state that "[w]hen the particle diameter . . .is made small, a density of contact points of the solid electrolyte layer . . . and the adhering electrode layers . . . increases" (*Id.*). Significant is the teaching of point contacts, such contacts between particles inevitably leading to porosity. The implied teaching of porosity is consistent with following paragraph [0032] which states that "the adhering layers . . . should be discontinuous thin film layers". There even then follows a definition of "discontinuous thin film layer" which explains that it means "not a continuous thin film" and "not uniformly dense".

Accordingly, Shibata's adhering cathode layers are formed of point-contacting particles and are not uniformly dense, which is exactly what is shown in Figure 1B (at right). As shown, the particles making up adhering cathode layer 21 are sometimes spaced apart, and sometimes in point contact with adjacent particles. The

FIG.1B



spaced apart regions are clearly porous. However, although the regions where there are point contacts appear to provide a continuous layer, consideration of the three-dimensional shape of the particles shows this to be wrong. That is, no matter how closely packed the particles are, there will always be interstices between the particles making the adhering cathode layer porous. For example, a section along plane A-A, added to Figure 1B by applicant, of a close packed region of particles might look something like:



As shown, even in this region there are interstices which create porosity and prevent the layer from being fully dense. Thus, in contrast to the apparent belief of the office action, Shibata discloses an adhering cathode layer which is porous at all regions. While, there may conceivably be differing degrees of porosity from region to region of the layer, there are no regions which are non-porous. Indeed, one skilled in the art would be very surprised to learn that the adhering cathode layer had any non-porous regions, because such regions would block the flow of gas between the electrolyte and the electricity collecting electrode, preventing those parts of the cell from functioning.

II. Conclusion:

For the foregoing reasons applicant submits that claims 1 and 65 (and claims 1-3, 8, 10, 13, 14, 21, 23, 65, 66, 68, 71, 73, and 74 which ultimately depend from one of claims 1 and 65) are in condition for allowance. The Examiner is requested to contact the undersigned at the telephone number appearing below if such would advance the prosecution of this application. While applicant believes that no additional fees are due, the Commissioner is hereby authorized to withdraw any additional fees deemed necessary for the filing of this or any other communication, from Deposit Account No. 23-3050.

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